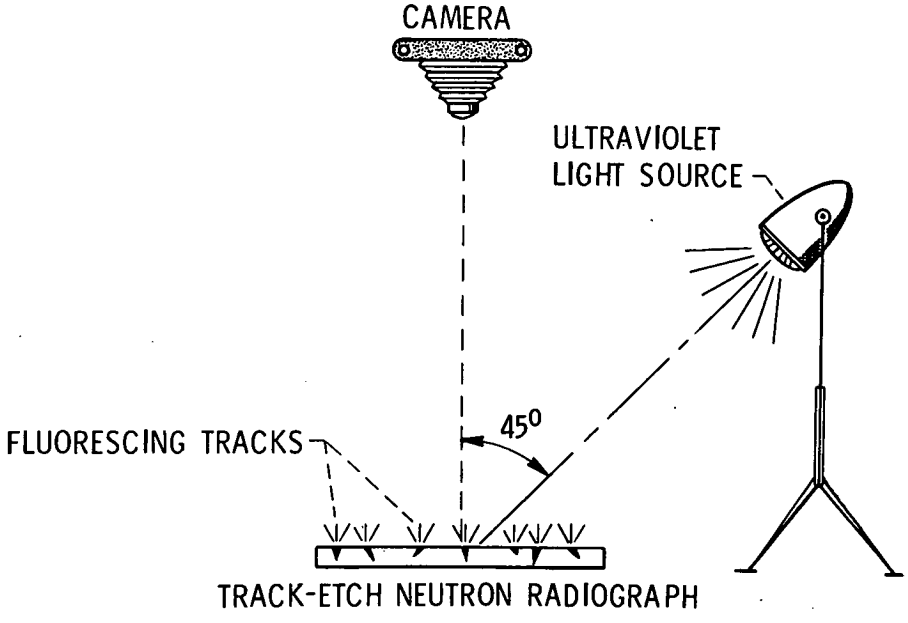
NASA TECH BRIEF

Lewis Research Center

TWO NEW METHODS TO INCREASE THE CONTRAST OF TRACK-ETCH NEUTRON RADIOGRAPHS

FLUORESCENT DYE METHOD



The Problem:

Track-etching is one of several methods used for recording neutron radiographs. This method consists of placing a piece of clear track recording material behind a converter screen located behind the subject exposed to a neutron beam. Neutrons passing through the subject and striking the converter screen cause ions to be emitted. These ions penetrate the clear track recorder material where they cause structural damage in their paths. The track recorder is then etched in a suitable reagent. The etching process selectively removes material from the damaged areas leaving pits or tracks. The arrangement of millions of these tracks in the recorder comprise the track-etch neutron radiograph. The track-etch method produces radiographs which are highly accurate but which are difficult to read because of poor contrast. Other systems are available but do not produce a sharp image and have poor contrast.

The Solution:

Two new methods have been developed for increasing the contrast of track-etch neutron radiographs. In one method, a fluorescent dye is deposited into the tracks of the radiograph and viewed under ultraviolet light. In the other method, the track-etch radiograph is placed between crossed polaroid filters, exposed to diffused light and the resulting image projected onto photographic film.

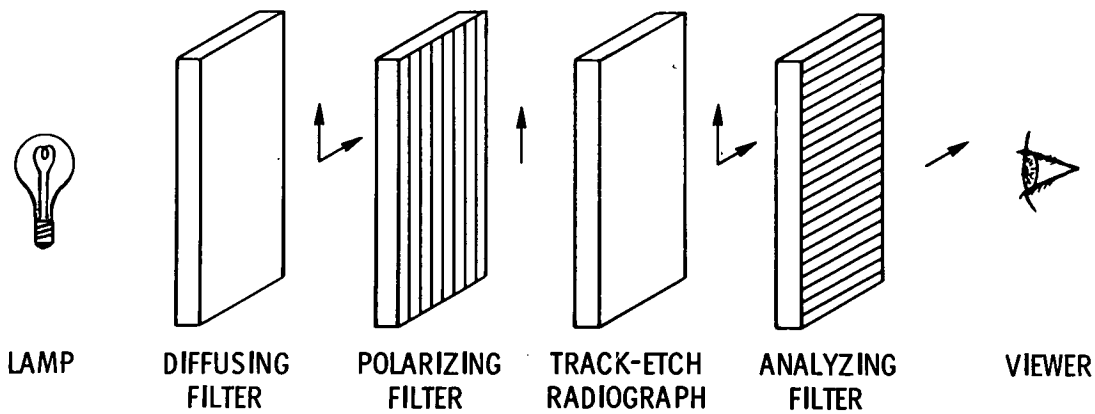
How It's Done:

FLUORESCENT DYE METHOD

The fluorescent dye technique used to enhance the contrast of track-etch neutron radiographs is shown in Figure 1. A fluorescent dye is sprayed onto the tracked side of the track-etch radiograph and allowed to partially dry. The surface of the radiograph is then wiped clean. The radiograph is placed on a flat dull black surface in a darkened room and illuminated with ultraviolet light

(continued overleaf)

CROSSED POLAROID METHOD



directed onto it at 45° from normal incidence. The 45° angle reduces the background interference caused by the blue and violet components of the ultraviolet light source. The dye trapped in the tracks absorbs the ultraviolet light and fluoresces. The tracked areas appear bright yellow, while the untracked areas appear essentially black. The fluorescing radiograph is then photographed from normal incidence. The optical density obtained by the fluorescent dye method is about 0.37.

CROSSED POLAROID METHOD

The crossed polaroid filter technique of enhancing the contrast of track-etch neutron radiographs is shown in Figure 2. The track-etch negative is placed between two light polarizing filters which have their polarizing axes oriented 90° from each other. Diffuse light is passed through the first filter (the polarizing filter), and polarized in one direction. The polarized light passes through the track-etch radiograph and then through the second filter (the analyzing filter). The portion of the polarized beam that passes through untracked areas of the radiograph is transmitted with its polarization unchanged, and filtered out by the analyzing filter. The portion of the polarized beam that strikes the tracked areas is scattered, the tracks in the radiograph serving as light scattering centers. The scattering process changes the polarization of that light so that a portion of it is polarized parallel to the optical axis of the analyzing filter. This portion of the beam is then transmitted onto the viewer. Since only that light which is scattered by the tracks is transmitted, only the track location information is transmitted to the viewer. The resulting image is viewed directly or projected onto photographic film. Since the tracks are randomly oriented, a diffuse light source is used to increase the probability of scattering. The optical density obtained by using the cross polaroid method is about 2.4.

Notes:

1. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)

   Reference: NASA TM-X-67947 (N72-12379), Two New Methods to Increase the Contrast of Track-Etch Neutron Radiographs
2. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B73-10027

Patent Status:

NASA has decided not to apply for a patent.

Source: James Morley
Lewis Research Center
(LEW-11893)